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ELECTRONICS

Product Information



TO : General

DATE : Nov.7, 2008.

SAMSUNG TFT-LCD**MODEL NO. : LTN170CT01-001**NOTE : Surface type [**Glare**]Any Modification of Spec is not allowed without SEC' permissionAPPROVED BY : PREPARED BY : **LCD Development Team 3****SAMSUNG ELECTRONICS CO., LTD.****Samsung Secret**

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Product Information

GENERAL DESCRIPTION

DESCRIPTION

LTN170CT01-001 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as switching devices. This model is composed of a TFT LCD panel, a driver circuit and a backlight unit. The resolution of a 17.0" contains 1,920 x 1200 pixels and can display up to 262,144 colors. 6 O'clock direction is the optimum viewing angle.

FEATURES

- High color gamut(72%), high contrast ratio, high aperture structure
- 1920 x 1200 pixels resolution
- Low power consumption
- Fast Response
- 2 CCFL (Y-stack)
- DE (Data enable) only mode
- 3.3V LVDS Interface
- Onboard EEDID chip
- Pb free product

APPLICATIONS

- Notebook PC
- If the usage of this product is not for PC application, but for others, please contact SEC

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	367.20(H) x 229.50(V) (17.0" diagonal)	mm	
Driver element	a-Si TFT active matrix		
Display colors	262,144		
Number of pixel	1920 x 1200	pixel	16 : 10
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.19125(H) x 0.19125(V) (TYP.)	mm	
Display Mode	Normally white		
Surface treatment	Haze 0, Hardness 3H		

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Mechanical Information

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Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	381.7	382.2	382.7	mm	(1)
	Vertical (V)	247.0	247.5	248.0	mm	
	Depth (D)	-	6.7	7.0	mm	
Weight		-	765	780	g	

Note (1) Measurement condition of outline dimension

. Equipment : Vernier Calipers

. Push Force : 500g · f (minimum)

1. ABSOLUTE MAXIMUM RATINGS

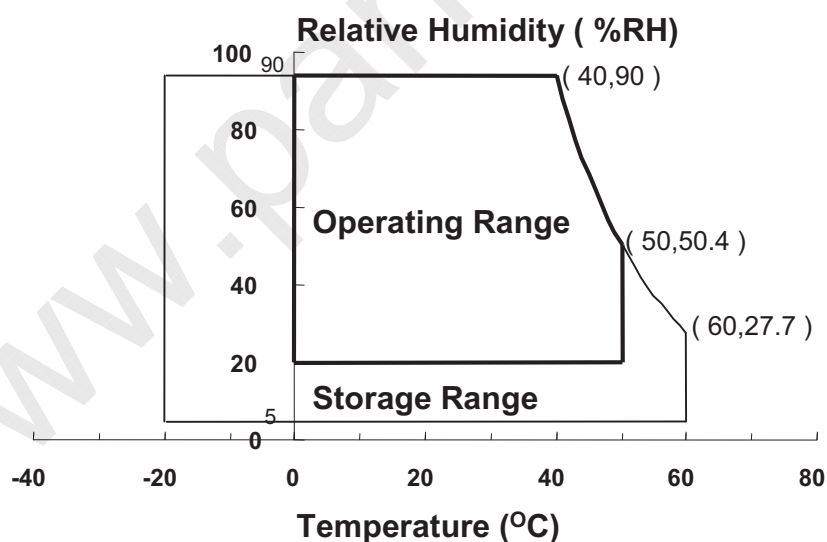
1.1 ENVIRONMENTAL ABSOLUTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperate	TSTG	-20	60	°C	(1),(5)
Operating temperate (Temperature of glass surface)	TOPR	0	50	°C	(1),(5)
Shock (non-operating)	Snop	-	240	G	(2),(4)
Vibration (non-operating)	Vnop	-	2.41	G	(3),(4)

Note (1) Temperature and relative humidity range are shown in the figure below.

95 % RH Max. ($40^{\circ}\text{C} \geq T_a$)

Maximum wet - bulb temperature at 39°C or less. ($T_a > 40^{\circ}\text{C}$) No condensation



(2) 2ms, half sine wave, one time for $\pm X$, $\pm Y$, $\pm Z$.

(3) 5 - 500 Hz, random vibration, 30min for X, Y, Z.

(4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be hard and rigid enough so that the Module would not be twisted or bent by the fixture.

(5) If product is used for extended time excessively or exposed to high temperatures for extended time, there is a possibility of wide viewing angle film damage which could affect visual characteristics.

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1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

 $V_{DD} = 3.3V$, $V_{SS} = GND = 0V$

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	$V_{DD} - 0.3$	$V_{DD} + 0.3$	V	(1)
Logic Input Voltage	V_{IN}	$V_{DD} - 0.3$	$V_{DD} + 0.3$	V	(1)

Note (1) Within T_a ($25 \pm 2^\circ C$)

(2) BACK-LIGHT UNIT

 $T_a = 25 \pm 2^\circ C$

Item	Symbol	Min.	Max.	Unit	Note
Lamp Current	I_L	3.0	6.5	mA	(1)
Lamp frequency	F_L	40	80	kHz	(1)

Note 1) Permanent damage to the device may occur if maximum values are exceeded

Functional operation should be restricted to the conditions described under normal operating conditions.

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2. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5).
Measuring equipment : TOPCON BM-5A and PR-705

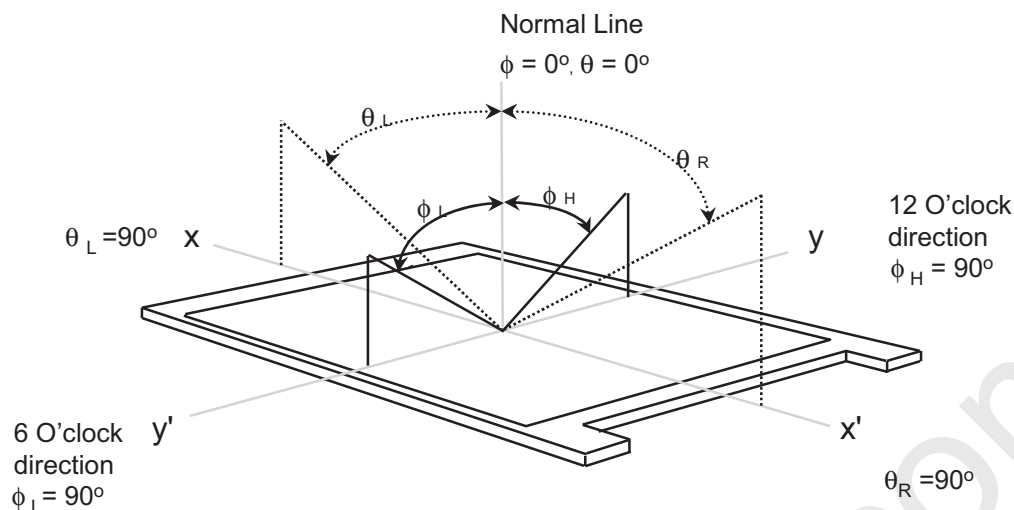
* Ta = 25 ± 2 °C, VDD=3.3V, fv= 60Hz, fDCLK = 81MHz, IL = 6.0 mA

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note
Contrast Ratio (5 Points)		CR	Normal Viewing Angle $\phi = 0$ $\theta = 0$	500	600	-	-	(1), (2), (5)
Response Time at Ta (Rising + Falling)		T _{RT}		-	8	12	msec	(1), (3)
Average Luminance of White (5 Points)		Y _{L,AVE}		340	400	-	cd/m ²	I _L =6.0mA (1), (4)
Color Chromaticity (CIE)	Red	R _X		0.615	0.645	0.675	-	(1), (5) PR-705
		R _Y		0.301	0.331	0.361		
	Green	G _X		0.262	0.292	0.322		
		G _Y		0.571	0.601	0.631		
	Blue	B _X		0.111	0.141	0.171		
		B _Y		0.041	0.071	0.101		
	White	W _X		0.283	0.313	0.343		
		W _Y	0.299	0.329	0.359			
Viewing Angle	Hor.	θ_L	CR ≥ 10	60	65	-	Degrees	(1), (5) BM-5A
		θ_H		60	65	-		
	Ver.	ϕ_H		40	45	-		
		ϕ_L		50	55	-		
13 Points White Variation		δ_L		-	-	2.2	-	(6)

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Note 1) Definition of Viewing Angle : Viewing angle range($10 \leq C/R$)

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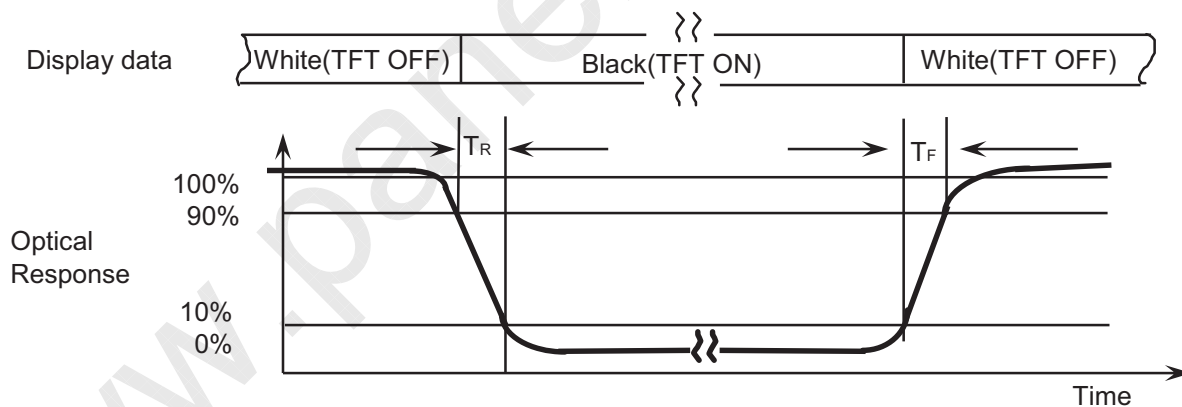


Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at 5 points(4, 5, 7, 9, 10)

$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$

Points : (4) , (5) , (7) , (9) , (10) at the figure of Note (6).

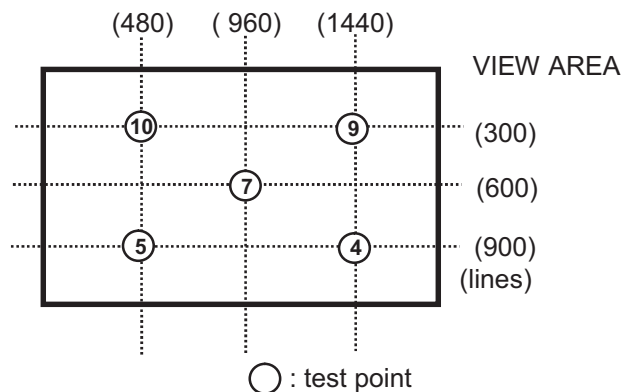
Note 3) Definition of Response time :



Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.

Average Luminance of White ($Y_{L,AVE}$)

$$Y_{L,AVE} = \frac{Y_{L4} + Y_{L5} + Y_{L7} + Y_{L9} + Y_{L10}}{5}$$



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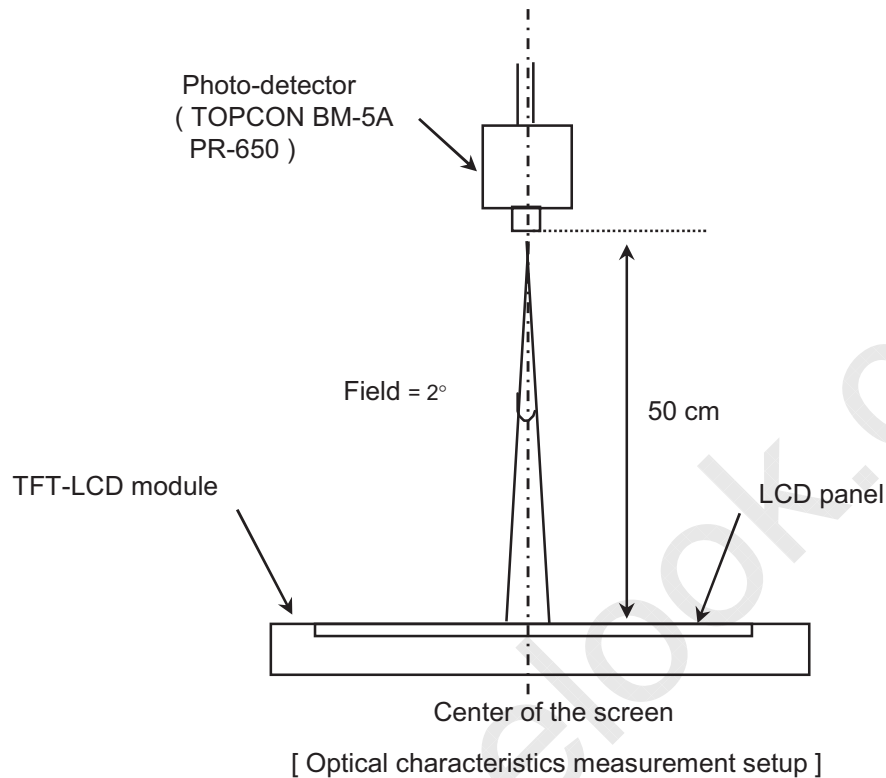
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Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the backlight. This should be measured in the center of screen.

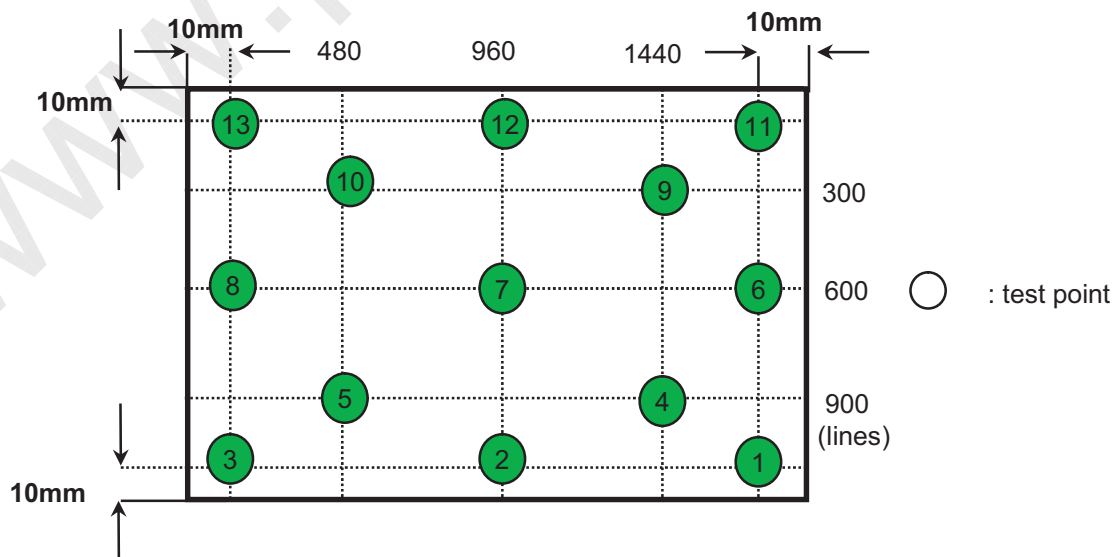
Lamp current : 6.5mA (Inverter : SIC-130T)

Environment condition : $T_a = 25 \pm 2 ^\circ\text{C}$



Note 6) Definition of 13 points white variation (δL), CR variation(C_{VER}) [① ~ ⑬]

$$\delta L = \frac{\text{Maximum luminance of 13 points}}{\text{Minimum luminance of 13 points}}$$



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3. ELECTRICAL CHARACTERISTICS

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3.1 TFT LCD MODULE

Ta= 25 ± 2°C

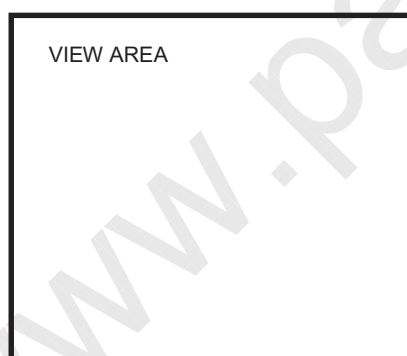
Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V _{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold	High	V _{IH}	-	-	+100	mV	V _{CM} = +1.2V
	Low	V _{IL}	-100	-	-	mV	
Vsync Frequency		f _v	-	60	-	Hz	
Hsync Frequency		f _H	-	75	-	KHz	
Main Frequency		f _{DCLK}	-	81	-	MHz	
Rush Current		I _{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White	I _{DD}	-	620	-	mA	(2),(3)*a
	Mosaic		-	670	-	mA	(2),(3)*b
	V. stripe		-	820	970	mA	(2),(3)*c

Note (1) Display data pins and timing signal pins should be connected.(GND = 0V)

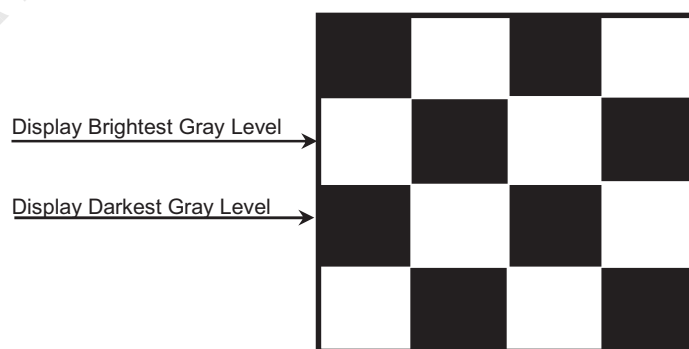
(2) f_v = 60Hz, f_{DCLK} = 81MHz, V_{DD} = 3.3V , DC Current.

(3) Power dissipation pattern

*a) White Pattern



*b) Mosaic Pattern



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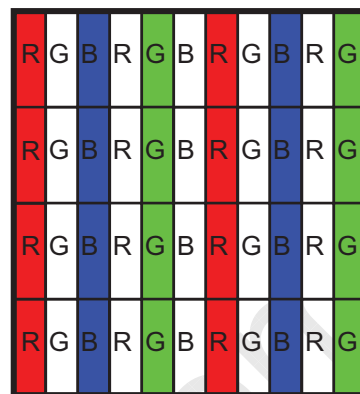
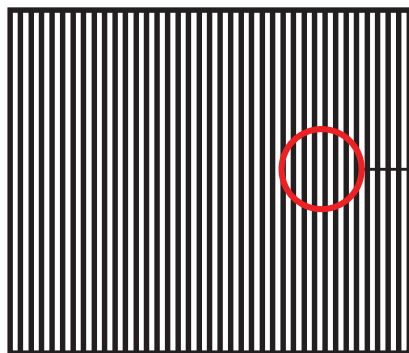
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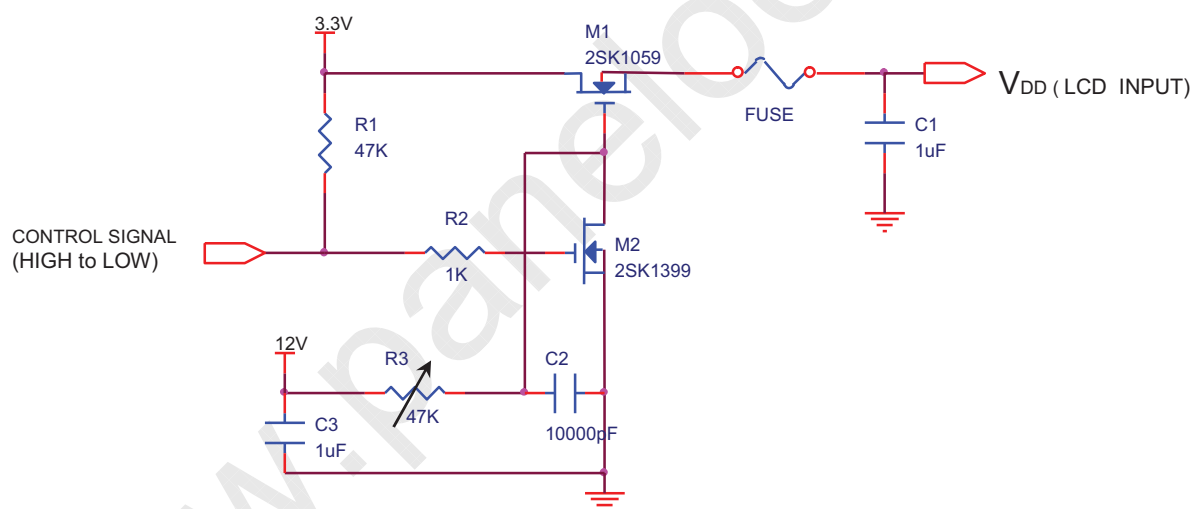
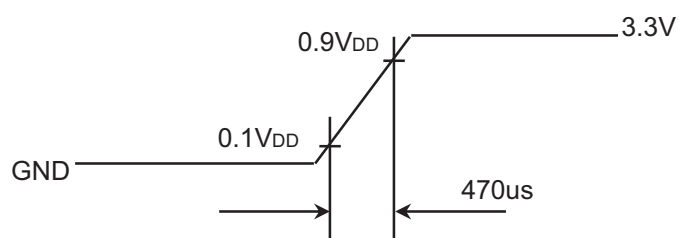
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*c) 1dot Vertical stripe pattern



4) Rush current measurement condition

V_{DD} rising time is 470us**Samsung Secret**

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3.2 BACK-LIGHT UNIT

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The backlight system is an edge-lighting type with dual CCFT (Cold Cathode Fluorescent Tube). The characteristics of a single lamp are shown in the following table.

- INVERTER : SEM SIC 1801

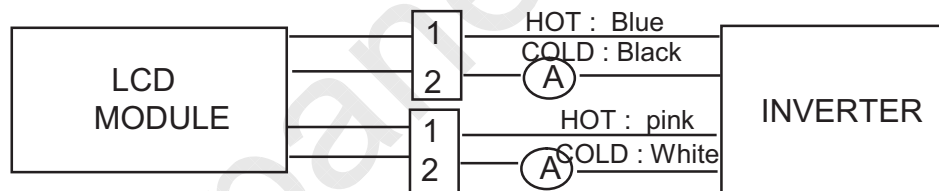
Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I _L	3.0	6.0	6.5	mArms	(1)
Lamp Voltage	V _L	-	720/CCFL	-	Vrms	I _L = 6.0mA
Frequency	f _L	40	60	65	KHz	(2)
Power Consumption	P _L	-	4.68/CCFL		W	(3) I _L = 6.0mA
Operating Life Time	Hr	10,000	-	-	Hour	(4)
Startup Voltage	V _s	-	-	1280	Vrms	25°C, (5)
				1600	Vrms	0°C, (5)

Note) The waveform of the inverter output voltage must be area symmetric and the design of the inverter must have specifications for the modularized lamp.

The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter(miss lighting, flicker, etc.) never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Note (1) Lamp current is measured with a high frequency current meter as shown below.



(2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

(3) Refer to I_L × V_L to calculate.

(4) Life time (Hr) of a lamp can be defined as the time in which it continues to operate under the condition Ta= 25 ± 2 °C and I_L = 6.0 mArms until one of the following event occurs.

1. When the brightness becomes 50% or lower than the original.
2. When the Effective ignition length becomes 80% or lower than the original value.
(Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

(5) The inverter open voltage - this voltage should be measured after ballast capacitor- have to be larger than the lamp startup voltage, otherwise backlight may has blinking for a moment after turns on or not be turned on.

If an inverter has shutdown function it should keep its open voltage for longer than 1 second even if lamp connector open.

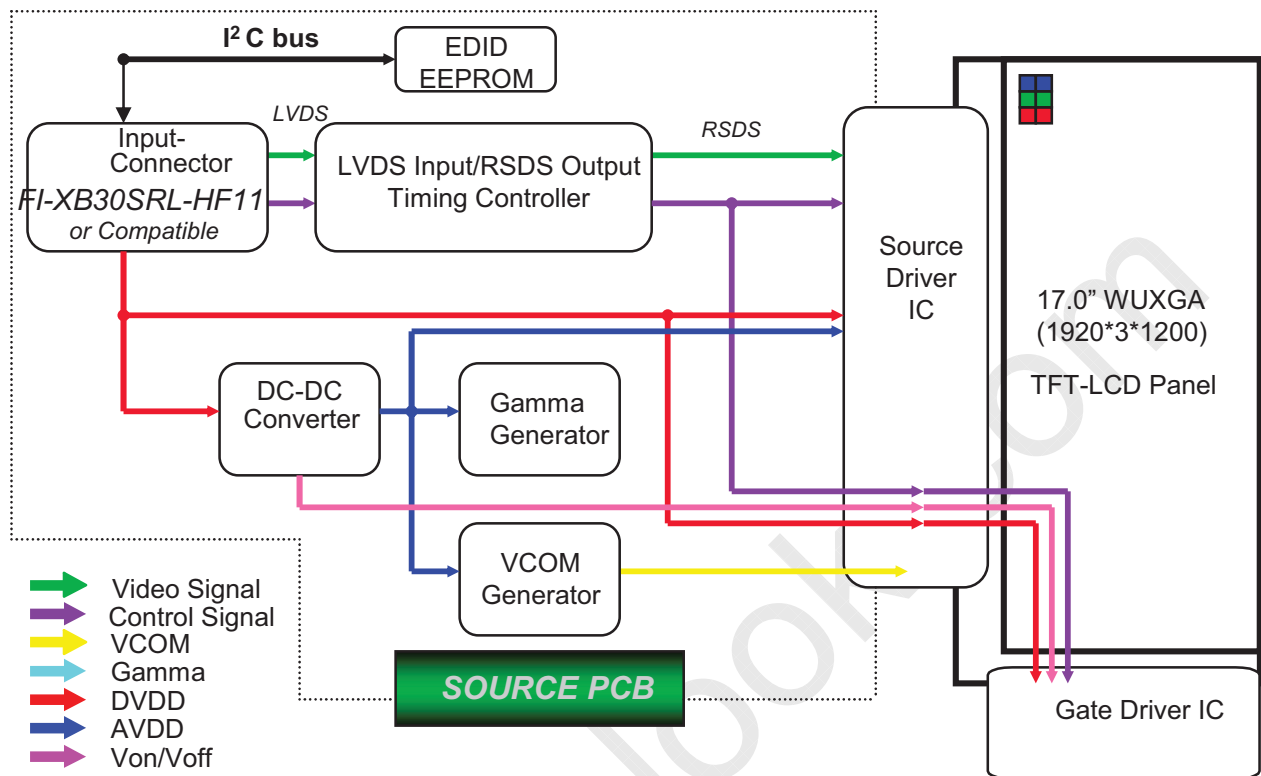
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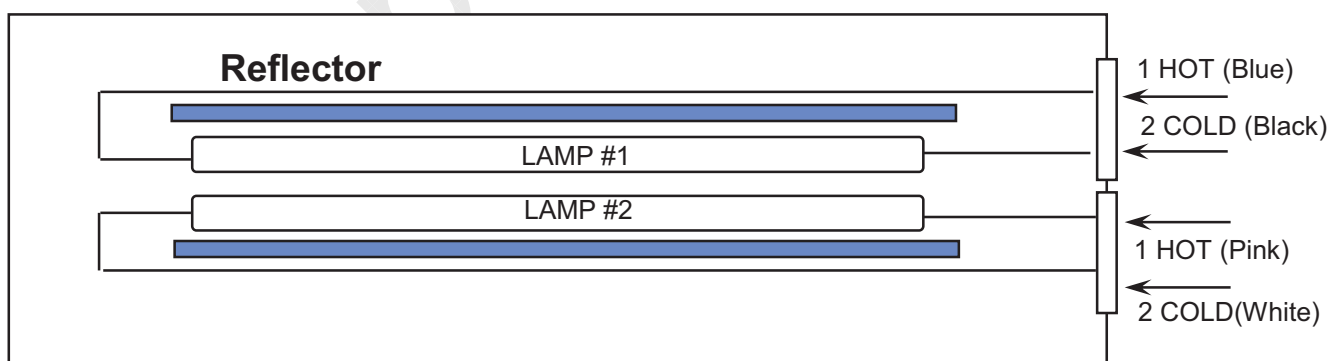
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4. BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 BACK-LIGHT UNIT

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5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (LVDS, Connector : JAE FI-XB30SRL-HF11 or compatible)
Mating Connector : JAE FI-X30M or compatible)

No.	Symbol	Function	Polarity	Remarks
1	VSS	Ground		
2	VDD	POWER SUPPLY +3.3V		
3	VDD	POWER SUPPLY +3.3V		
4	VEEDID	DDC 3.3V Power		
5	NC	No Connection		
6	CLKEDID	DDC Clock		
7	DATAEDID	DDC data		
8	O_RxIN0-	LVDS Differential Data INPUT (Odd R0-R5,G0)	Negative	
9	O_RxIN0+	LVDS Differential Data INPUT (Odd R0-R5,G0)	Positive	
10	GND	Ground		
11	O_RxIN1-	LVDS Differential Data INPUT (Odd G1-G5,B0-B1)	Negative	
12	O_RxIN1+	LVDS Differential Data INPUT (Odd G1-G5,B0-B1)	Positive	
13	GND	Ground		
14	O_RxIN2-	LVDS Differential Data INPUT (Odd B2-B5,Sync,DE)	Negative	
15	O_RxIN2+	LVDS Differential Data INPUT (Odd B2-B5,Sync,DE)	Positive	
16	GND	Ground		
17	O_RxCLK-	LVDS Differential Data INPUT (Odd Clock)	Negative	
18	O_RxCLK+	LVDS Differential Data INPUT (Odd Clock)	Positive	
19	GND	Ground		
20	E_RxIN0-	LVDS Differential Data INPUT (Even R0-R5,G0)	Negative	
21	E_RxIN0+	LVDS Differential Data INPUT (Even R0-R5,G0)	Positive	
22	GND	Ground		
23	E_RxIN1-	LVDS Differential Data INPUT (Even G1-G5,B0-B1)	Negative	
24	E_RxIN1+	LVDS Differential Data INPUT (Even G1-G5,B0-B1)	Positive	
25	GND	Ground		
26	E_RxIN2-	LVDS Differential Data INPUT (Even B2-B5,Sync,DE)	Negative	
27	E_RxIN2+	LVDS Differential Data INPUT (Even B2-B5,Sync,DE)	Positive	
28	GND	Ground		
29	E_RxCLK-	LVDS Differential Data INPUT (Even Clock)	Negative	
30	E_RxCLK+	LVDS Differential Data INPUT (Even Clock)	Positive	

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5.2 LVDS Interface : Transmitter DS90CF363 or Compatible

LVDS for Odd pixel

Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
44	TxIN0	RO0	12	TxIN11	GO5
45	TxIN1	RO1	13	TxIN12	BO0
47	TxIN2	RO2	15	TxIN13	BO1
48	TxIN3	RO3	16	TxIN14	BO2
1	TxIN4	RO4	18	TxIN15	BO3
3	TxIN5	RO5	19	TxIN16	BO4
4	TxIN6	GO0	20	TxIN17	BO5
6	TxIN7	GO1	22	TxIN18	Hsync
7	TxIN8	GO2	23	TxIN19	Vsync
9	TxIN9	GO3	25	TxIN20	DE
10	TxIN10	GO4	26	TxCLK IN	Clock

LVDS for Even pixel

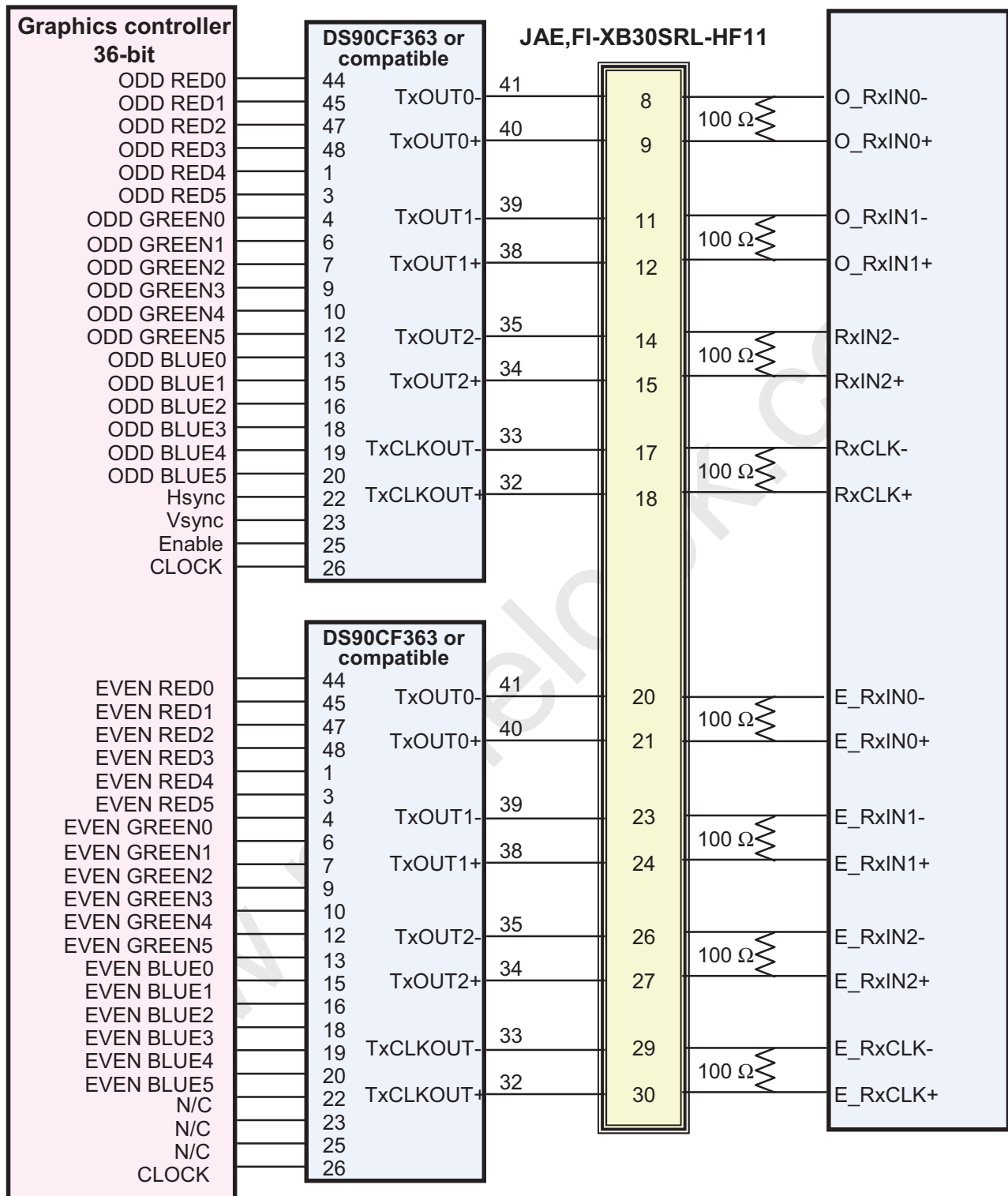
Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
44	TxIN0	RE0	12	TxIN11	GE5
45	TxIN1	RE1	13	TxIN12	BE0
47	TxIN2	RE2	15	TxIN13	BE1
48	TxIN3	RE3	16	TxIN14	BE2
1	TxIN4	RE4	18	TxIN15	BE3
3	TxIN5	RE5	19	TxIN16	BE4
4	TxIN6	GE0	20	TxIN17	BE5
6	TxIN7	GE1	22	TxIN18	N/C
7	TxIN8	GE2	23	TxIN19	N/C
9	TxIN9	GE3	25	TxIN20	N/C
10	TxIN10	GE4	26	TxCLK IN	Clock

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LVDS Interface



Note : The LCD Module uses a 100ohm resistor between positive and negative lines of each receiver input.

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5.3 BACK LIGHT UNIT

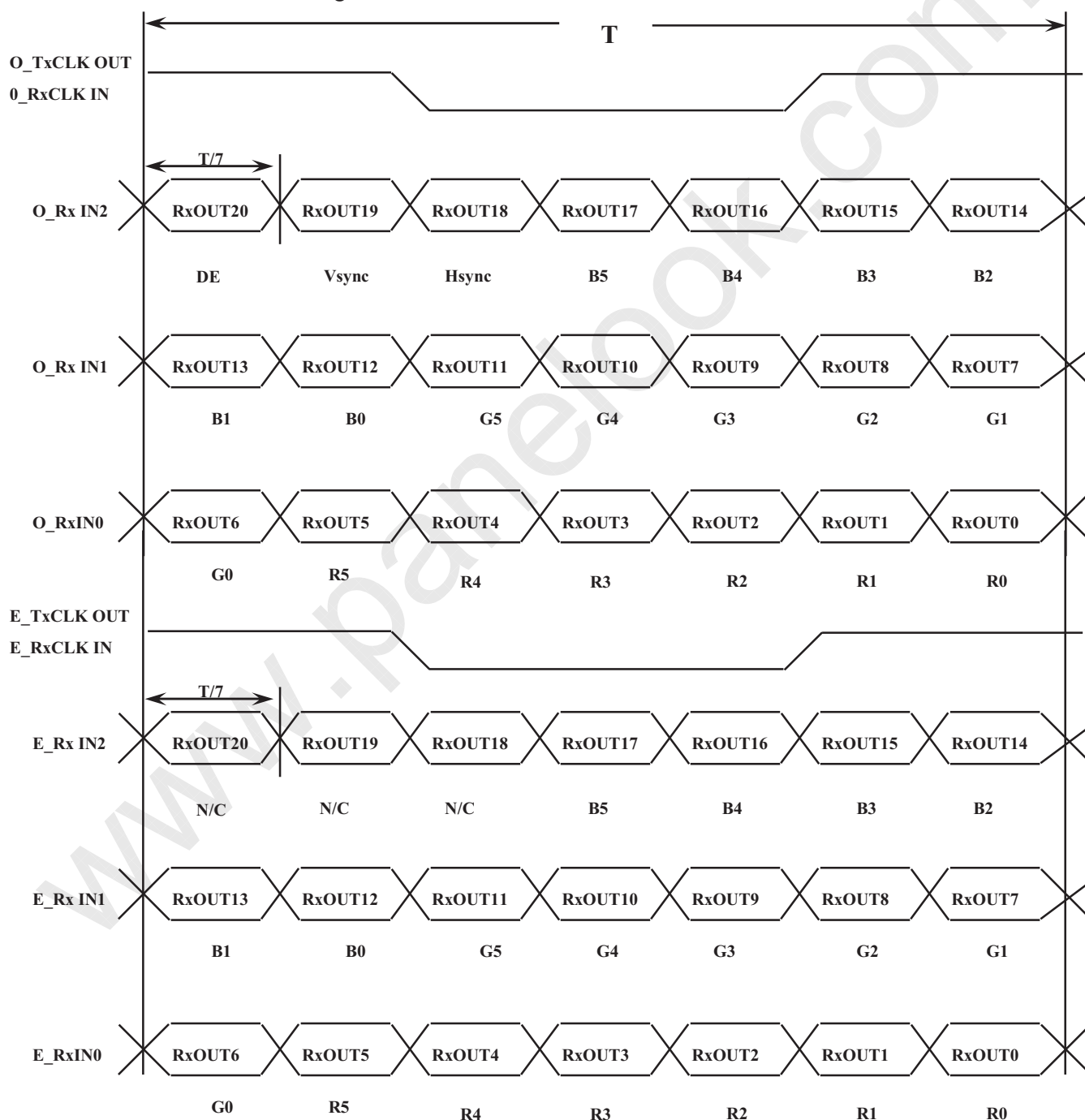
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Connector : JST BHSR - 02VS -1
Mating Connector : SM02B-BHSS-1(JST)

Pin NO.	Symbol	Color	Function
1	HOT	Pink/Blue	High Voltage
2	COLD	White/Black	Low Voltage

5.4 Timing Diagrams of LVDS For Transmission

LVDS Receiver : Integrated T-CON



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5.5 Input Signals, Basic Display Colors and Gray Scale of Each Color

Color	Display	Data Signal																	Gray Scale Level	
		Red						Green						Blue						
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	45		B5
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	-
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	-
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	-
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	-
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	-
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	-
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
Gray Scale Of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	Dark	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
	↑	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	↓	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R61
	Light	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R62
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R63
Gray Scale Of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	Dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	G1
	↑	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	G2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	↓	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	G61
	Light	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	G62
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	G63
Gray Scale Of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	B1
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	↓	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	B61
	Light	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B62
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	B63

Note 1) Definition of gray :

Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)

Note 2) Input signal: 0 =Low level voltage, 1=High level voltage

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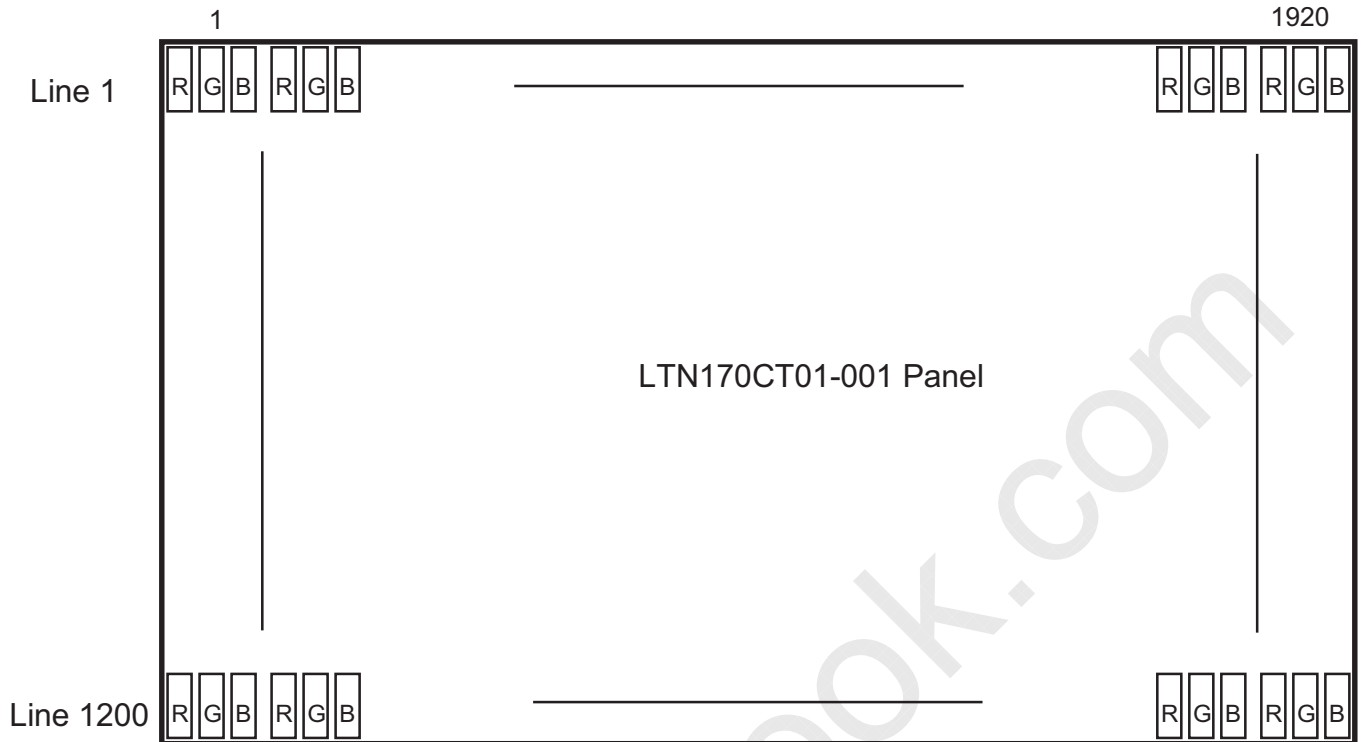
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Product Information

5.6 Pixel Format in the display



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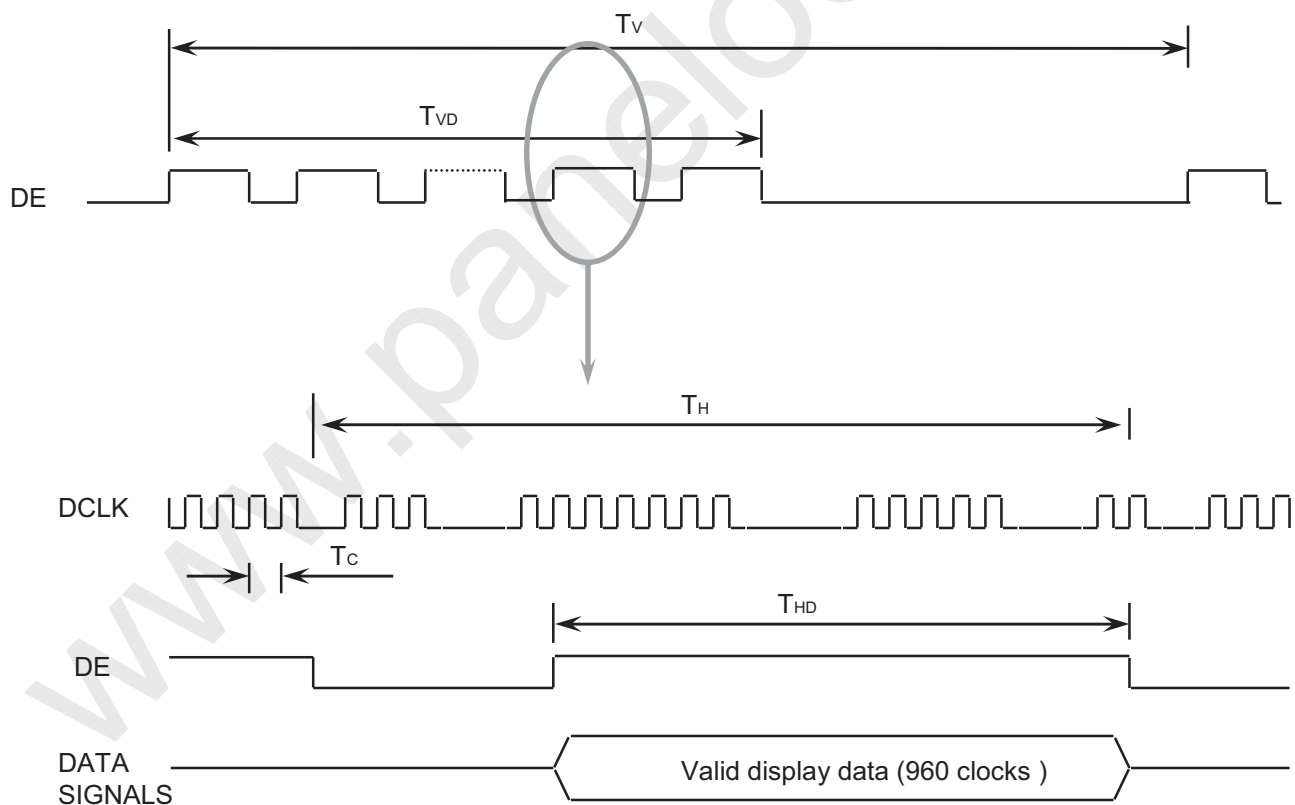
6. INTERFACE TIMING

Product Information

6.1 Timing Parameters

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	TV	1205	1220	1400	Lines	
Vertical Active Display Term	Display Period	TVD	-	1200	-	Lines	
One Line Scanning Time	Cycle	TH	1102	1104	1460	Clocks	
Horizontal Active Display Term	Display Period	THD	-	960	-	Clocks	

6.2 Timing diagrams of interface signal



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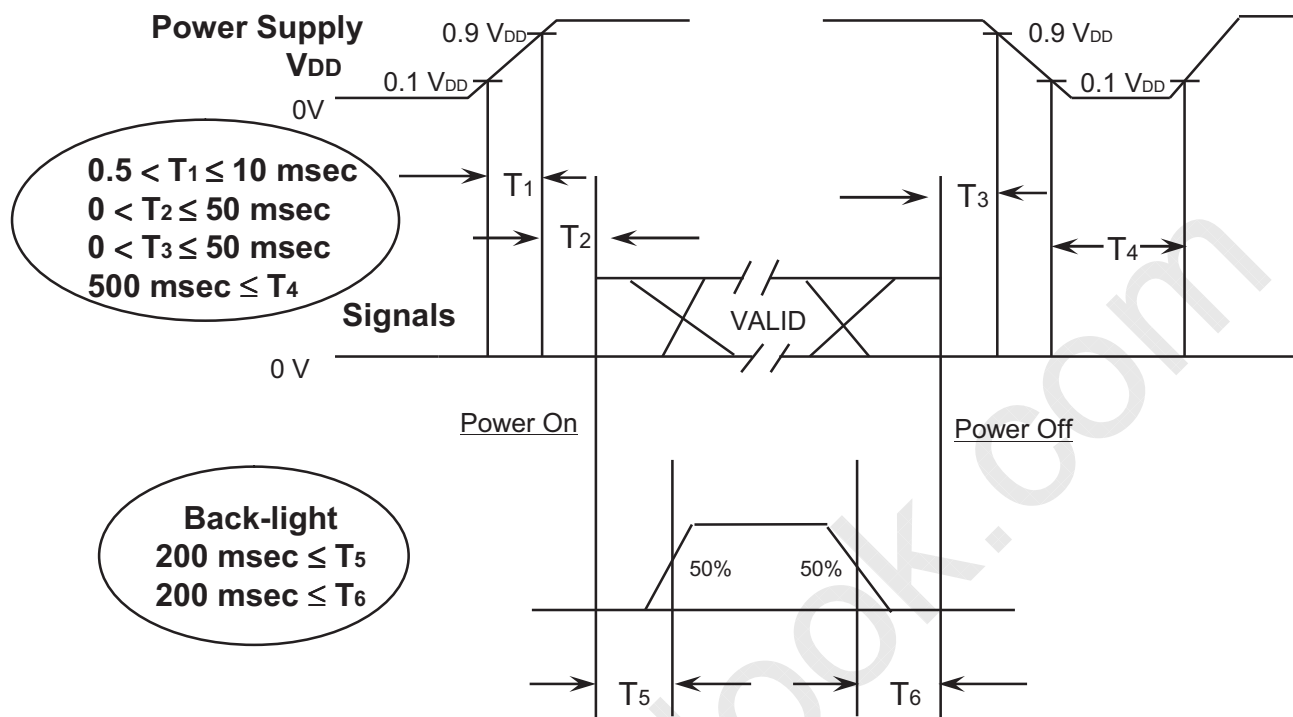
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6.3 Power ON/OFF Sequence

Product Information

: To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.



Power ON/OFF Sequence

- T1 : Vdd rising time from 10% to 90%
- T2 : The time from Vdd to valid data at power ON.
- T3 : The time from valid data off to Vdd off at power Off.
- T4 : Vdd off time for Windows restart
- T5 : The time from valid data to B/L enable at power ON.
- T6 : The time from valid data off to B/L disable at power Off.

NOTE.

- (1) The supply voltage of the external system for the module input should be the same as the definition of VDD.
- (2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.
- (3) In case of VDD = off level, please keep the level of input signals on the low or keep a high impedance.
- (4) T4 should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.

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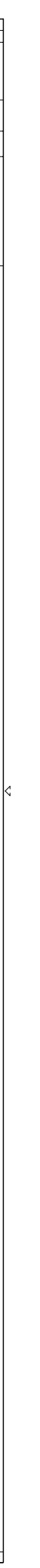
7. Mechanical Outline Dimension

Product Information

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8. PACKING

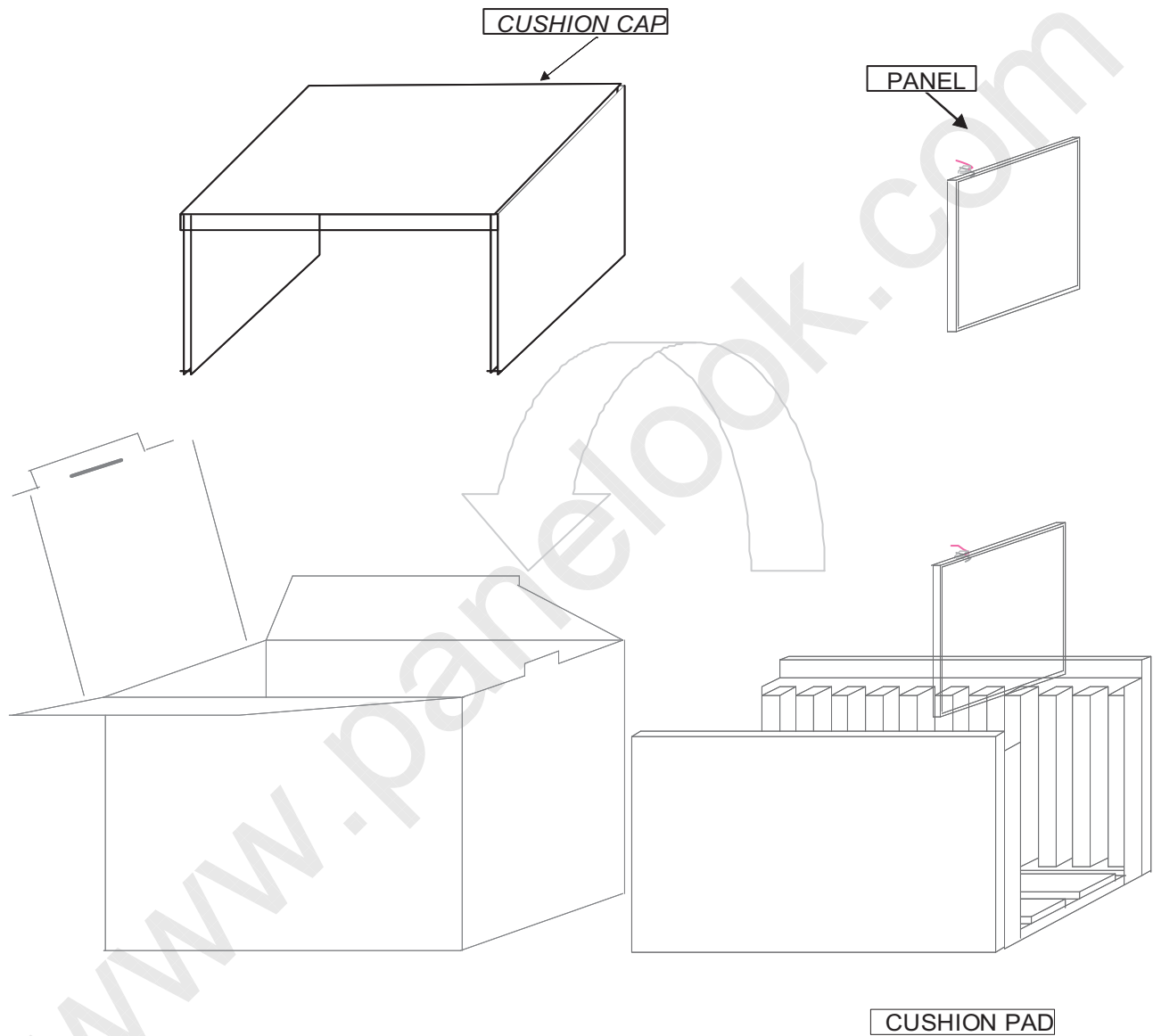
Product Information

1. CARTON(Internal Package)

(1) Packing Form

Corrugated Cardboard box and Corrupad form as shock absorber

(2) Packing Method



Note 1) Total Weight : Approximately 10 kg
2) Acceptance number of piling : 10 sets
3) Carton size : 376(W)×326(D)×404(H)

PACKING CASE

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No	Part name	Quantity
1	Static electric protective sack	10
2	Packing case (Inner box) included shock absorber	1 set
3	Pictorial marking	2 pcs
4	Carton	1 set

Product Information

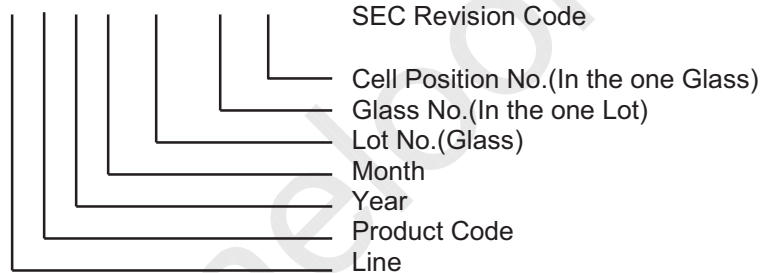
9. MARKINGS & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

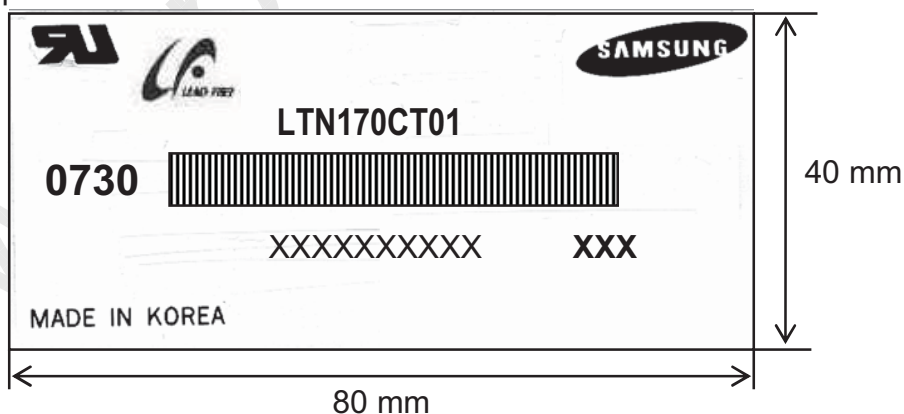
(1) Parts number : LTN170CT01-001

(2) Revision : Three letters

(3) Lot number : X X X X XXX XX X XXX



(4) Nameplate Indication



Parts name : LTN170CT01-001
 Lot number : XXXXXXXXXX
 Inspected work week : 0730(2007 year 30th week)
 Product Revision Code : XXX

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